

STRP Synthesis S3

Transit's Safety and Security Record

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Canadian Urban Transit Association
Association canadienne du transport urbain

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Le programme de recherche stratégique de transport en commun (PRSTC) est un programme national et coopératif de recherche pour l'industrie du transport en commun au Canada. La coordination et gestion de ce programme est assurée par l'Association canadienne du transport urbain. Le programme est rendu possible par le soutien financier des organisations suivantes:

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Transit's Safety and Security Record

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Sypher:Mueller International Inc.

November 2000

CUTA Mission Statement

CUTA is the association of providers of urban transit services, suppliers and related organizations in Canada. Its mission is to promote the role of urban transit in enhancing mobility, and to support its members in the fulfilment of their mandate.

Disclaimer

The contents of this report reflect the views of the author(s) based on their research, but do not necessarily reflect the official views or opinions of the Canadian Urban Transit Association, nor of the organizations funding the Strategic Transit Research Program.

Printed and bound in Canada

Toronto, 2000

STRP S3

ISBN 0-920559-60-3

CUTA REPORT DOCUMENTATION FORM

CUTA Synthesis No. STRP Synthesis S3	ISBN No. 0-920559-60-3	Publication Date November 2000
Title and Sub-Title Transit's Safety and Security Record		
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Supplementary Notes This report was prepared under CUTA's Strategic Transit Research Program which is co-funded by Transport Canada, the provinces of Quebec and Ontario, and twelve local transit systems.		
Abstract This study documents transit's safety and security record, and gives comparisons of the safety record with other modes and of the security record with crime levels in the community. Sources of information and potential approaches, based on Canadian and U.S. sources, are discussed. Fatality and injury rates per passenger-kilometer of travel are identified as the appropriate measure of safety for passenger transit. Weaknesses in the current data sources for determining the levels of safety and security are discussed and improvements are recommended. The analysis concluded that transit provides the safest means of travel in urban areas, and only travel on major scheduled air carriers has lower fatalities for each passenger kilometer of travel. The limited data on security incidents indicates that transit passengers in stations or onboard transit vehicles are substantially more secure than the overall urban population.		
Key Words Urban Transit; Public Transportation Safety; Poublic Transportation Security; Safety Statistics	Language English (Ce rapport sera disponible en français)	
No. of Pages 48	Distribution This report is available from CUTA.	

TRANSIT'S SAFETY AND SECURITY RECORD

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Executive Summary

There are 65 transit agencies in Canada serving municipalities with a total population of 17.4 million people. These transit operations carried 1.38 billion passengers for an average of 9.4 kilometers each, thus providing a total of 13 billion passenger-kilometers of travel. Transit accounts for 2.1% of the passenger-kilometers of travel by Canadians, and 4.2% of travel within urban areas.

Documenting the safety and security record of transit is difficult due to the lack of comprehensive and systematic reporting of these incidents by transit agencies. Road transit accident data is collected by provincial departments and compiled into a national database by Transport Canada. Some differences exist between the classification schemes used by each province which makes it difficult to combine, and some accuracy or detail is lost. Accidents involving transit passenger getting on or off the bus can be identified in the data, but accidents when they are walking to and from the bus stop cannot be identified. Rail accident data collected by the Transportation Safety Board (Canada) excludes subway and most commuter rail and does not include accidents at the station unless it involves the train. Rail fatality information was obtained directly from the rail transit operators and verified using computer searches of news articles. Injury data has been reported on a voluntary basis by transit properties to CUTA in the past, but only 50% to 60% of properties reported and data quality was poor.

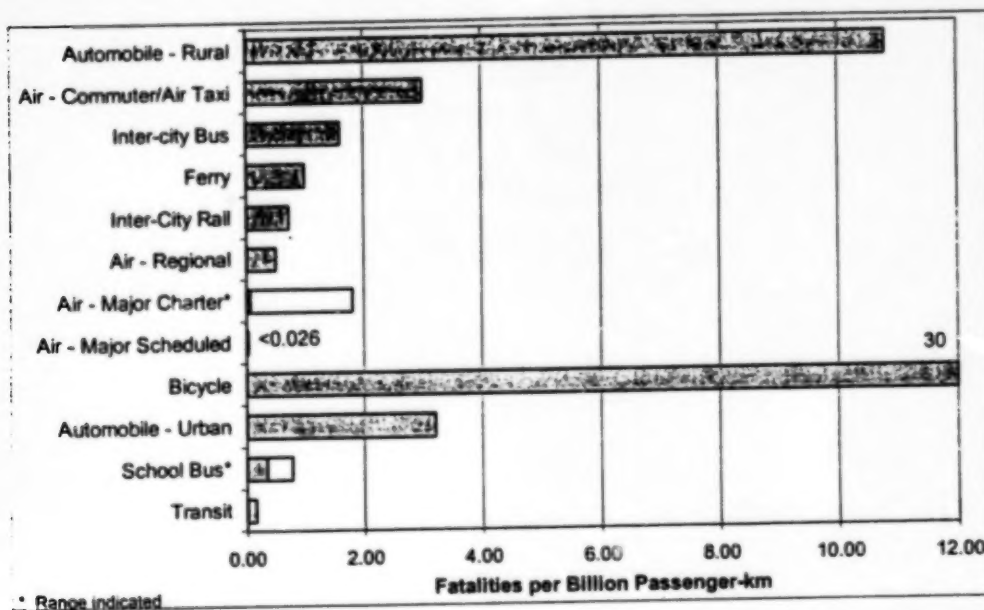
The safety of transit was measured by the number of fatalities and injuries to passengers relative to the number of passenger-kilometers of travel. Not all transit properties report passenger-kilometers of travel and it was necessary to estimate this based on reported passenger trips and the average trip length of the more than 50% of properties reporting this data. The passenger fatality and injury rates were estimated to be:

On-board fatality rate	0.045 per billion passenger-km
Entry/exit fatality rate	0.112 per billion passenger-km
Total pass. fatality rate	0.157 per billion passenger-km
Injury rate	300 per billion passenger-km

These rates exclude walking to and from the station/bus stop, and the injury rate includes injuries sustained in collisions, while boarding or exiting the vehicle, and while inside the vehicle, station or bus stop. US accident data indicate that almost all fatalities involve collisions of the transit vehicle (including collisions with pedestrians), while two-thirds of injuries occur in non-collision accidents.

Comparison of the levels of safety of the various forms of passenger transportation is complicated by the different systems and procedures used to report transportation accident data, and differences in the types of risk (e.g., on or off the vehicle) and the operating environments of the various modes. Despite these differences, it is possible to develop a fairly clear picture of the safety of transit relative to other modes of travel.

The passenger fatality rates for the different modes of travel examined are shown in Exhibit 1. The modes used in urban areas are grouped together at the bottom of the figure. Transit has the lowest fatality rate in urban areas and the second lowest rate overall.



Notes: Rates based on most recent 10 year period data was available for Canada, except air, 16 years; inter-city bus, 13 years; and bicycle, 5 years US data.
 Transit excludes fatalities walking to and from the station or bus stop
 School bus range due to inclusion/exclusion of pedestrian accidents
 Air major charter range due to inclusion/exclusion of one catastrophic accident

Exhibit 1. Passenger Fatality Rates for Different Modes of Travel

Injury rates for transit are similar to those for urban and rural automobile travel, but higher than bus school and inter-city bus. Overall, transit provides the safest means of travel in urban areas, and only travel on major scheduled air carriers has lower fatalities for each passenger kilometer of travel.

Only limited data is available on the security of passengers using transit. There are no national guidelines to assist transit properties in collecting security statistics. One of the difficulties in compiling incident statistics for transit is that many incidents involving passengers that might occur at bus stops, or walking to and from a bus stop or station, are not reported to the transit agency. In addition, there are likely many behavioural incidents that intimidate transit patrons that are not reported, or would be difficult to classify under a specific statute.

The limited data available shows that transit passengers in stations or on-board transit vehicles are substantially more secure than the overall urban population. The perceptions that may exist about the lack of security on transit may be more related to the potential

for incidents beyond the transit service itself, such as walking between a bus stop and place of residence.

Developing a complete and accurate picture of transit safety and security will be difficult. Standardized reporting of accidents and security incidents by the transit agencies would provide measures of safety and security while on transit property. The safety and security of passengers walking to and from the station or bus stop, or while waiting at bus stops, could only be measured by including specific transit related questions in incident/accident data forms. In the wider context that this data is collected, inclusion of specific transit related questions could not be justified.

Recommendations

Based on our analyses and findings, we recommend the following:

Relative Safety/Security of transit

- Publicize and promote the excellent safety and security record of transit to draw public support for transit and increase ridership.

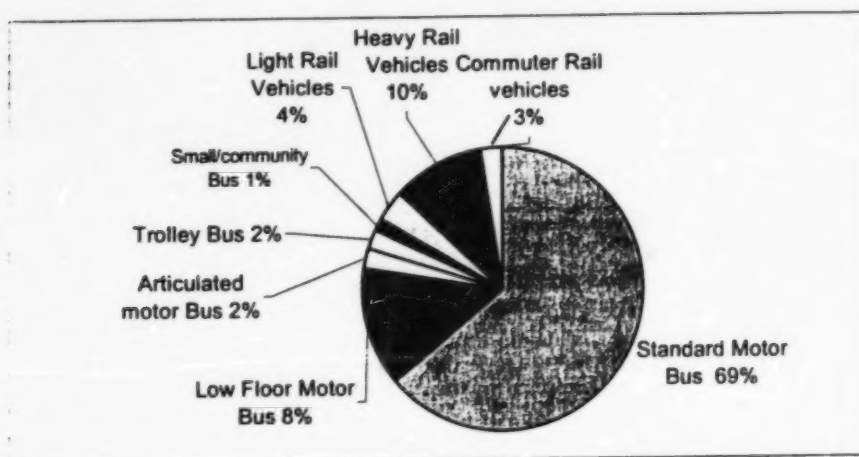
Data collection requirements

- Passenger-kilometers of travel data should be collected to enable accurate injury and fatality rates to be determined.
- There should be routine reporting of fatalities and injuries using standardized reporting procedures, similar to those used by the US Federal Transit Administration. Fatalities and injuries to transit passengers, transit staff and to other people should be recorded separately.
- There should be routine reporting of security incidents involving passengers using standardized reporting procedures based on criminal code activity, similar to those used by the US Federal Transit Administration.

I. INTRODUCTION

A. Background

There are 65 transit agencies in Canada serving municipalities with a total population of 17.4 million people. All transit agencies offer services by bus, while six of the largest agencies provide services by rail, and two offer services by ferry. As shown in Exhibit I-1, in 1998 buses comprise 83% of the active transit fleet, the large majority of these being standard buses. Rail vehicles comprise 17% of the active fleet, although rail provides a higher proportion of the passenger-kilometers of travel due to the higher capacity of rail vehicles or faster operating speed.



[Source: CUTA, 1998]

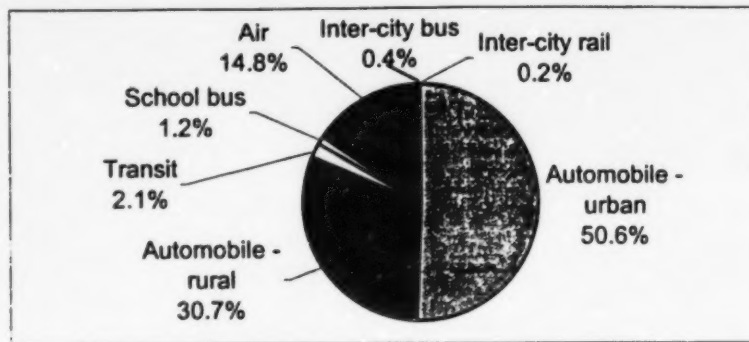
Exhibit I-1 Distribution of Active Transit Vehicles in the Canada

According to CUTA's statistics, transit operations carried 1.38 billion passengers in 1998 for an average of 9.4 kilometers each, thus providing a total of 13 billion passenger-kilometers of travel.

Transit accounts for 2.1% of the passenger-kilometers of travel by Canadians, as shown in Exhibit I-2. Considering public modes of travel, transit accounts for 11% of passenger-kilometers of travel and 62% of passenger trips (see Exhibit I-3). Within urban areas, transit accounts for 4.2% of the passenger-kilometers of travel.

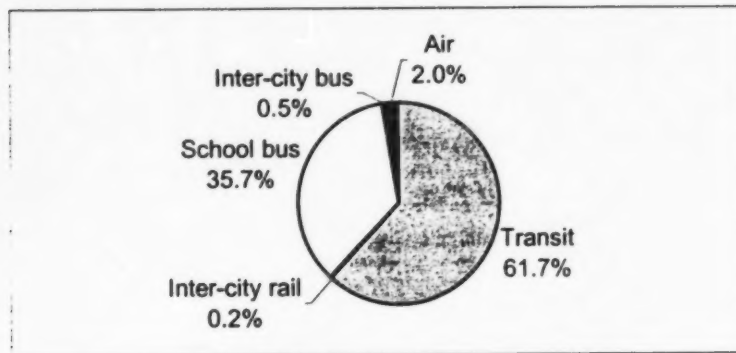
B. Objectives

The objective of this study was to identify potential sources of information and potential approaches, based on Canadian and U.S. sources, for documenting transit's positive safety and security record, especially with comparison to other modes.



[Source: CUTA 1998, Statistics Canada, Transport Canada, Stewart]

Exhibit I-2 Distribution of Passenger-Kilometers of Travel by Mode



[Source: CUTA 1998, Statistics Canada, Transport Canada]

Exhibit I-3 Distribution of Passenger Trips on Public Transport by Mode

The report documents the safety level of passenger travel by transit and compares it with the level of safety for other modes of travel. The modes considered are:

- Transit
- School bus
- Automobile – Urban and non-urban
- Inter-city bus
- Inter-city rail
- Air carrier
- Passenger ferry
- Bicycle

Issues associated with the security of passengers travelling on transit and the reporting of security incidents are discussed, and comparisons made with crime rates in Canadian cities.

II. MEASURING SAFETY

A transport system is safe if it can transport people from their origin to destination free of danger and injury. The safety of a system is measured in terms of the frequency of occurrence of danger or injury relative to the exposure of people using the system to danger and injury. The actual measures of safety that are employed depend on the use to be made of the safety measure and the availability of data to estimate the measure.

Focus

The focus of this report is on the safety of transit in comparison with other modes of passenger travel. An exposure measure such as total distance travelled by passengers is the appropriate base on which to make this comparison. Measures such as **the numbers of injuries and fatalities per billion passenger-kilometers of travel** were therefore used.

Passenger-kilometers is defined as the total kilometers actually travelled by all passengers, and can be calculated by summing each passenger's trip length, or multiplying the number of passengers by their average trip length.

Injuries differ in severity and, unfortunately when recording injury data, the various authorities and jurisdictions are not consistent in what constitutes an injury or different classes of injury (e.g. minor, serious). In addition, if minor injuries are included, under-reporting of injuries may occur. Care should therefore be taken when comparing injury rates across modes or between jurisdictions. Fatality rates provide a more consistent measure, but are less reliable when based on only a small number of fatalities, such as in the case of transit. In these situations, long time periods may be required to obtain reliable estimates of the inherent risk, but this may overestimate the current risk if the risk is decreasing over time. Fatality rates used in the comparisons in this research are based on average rates for the latest 10 year period for which data is available, usually 1988 to 1997 or 1989 to 1998.

The safety measures will focus, where possible, on the safety of passengers and will therefore not consider the occupants of other vehicles in collision accidents. The safety of the paid staff in publicly available transportation will not be considered in the passenger safety comparisons. However, drivers of automobiles will be included in the comparisons as the large majority of automobile travel is conducted to transport both the driver and passengers.

Sources of Data

A number of different sources were used to obtain the data on fatalities and injuries, and on the distances travelled by passengers. The major sources used were (reports are given in the Reference section):

- Statistics Canada – Catalog 53-215-XPB gives the number of passengers, distance travelled by vehicles for transit, school buses and inter-city buses; catalog 51-206

gives passenger-kilometers of travel by air, and catalog 52-216 gives passenger-kilometers of travel by rail.

- Traffic Safety Standards and Research Branch, Road Safety and Motor Vehicle Directorate, Transport Canada, "Traffic Accident and Information Databank" (TRAID) database has detailed data on fatalities and injuries in road accidents. An annual report (TP 3322) gives fatalities and injuries of drivers, passengers and pedestrians of all road users, but it is necessary to make a special request to obtain this data for each type of bus.
- The Transportation Safety Board, Canada (TSB) collects data on fatalities and injuries in air, rail and marine accidents, but the required data is not published and must be obtained through a special request. TSB covers only rail operations that are federally regulated, and excludes subways, light rail and most commuter rail. The categories used to report aviation accidents are different from those used to report passenger-kilometers and it is therefore necessary to individually classify the aviation accidents according to the categories used for passenger-kilometers.
- CUTA publishes data on the number of passengers and average trip distance, and in the past, collected injury data for travel by transit, but the data has several limitations. Only half the transit operators report average trip distance and the passenger-kilometers are estimated based on this sub-set of operators. CUTA's last published Transit Safety Statistics was in 1995. This report has subsequently been discontinued for a number of reasons, including definition problems, low response rates, poor data reliability and lack of resources to conduct this survey.
- Federal Transit Administration reports fatality, injury, security incidents and passenger-kilometer data for transit in the US.
- Transit operators were contacted to provide data on rail transit fatalities, for which there is not a comprehensive national database, and security incidents on transit.

As is often the case in safety analyses, the most difficult data to obtain is the exposure data. Statistics Canada reports passenger-kilometers of travel for air and rail (inter-city) modes. For transit, estimates of passenger-kilometers are obtained by multiplying the number of passengers by the average distance they travel. For school and inter-city bus modes, estimates are found by multiplying the average number of passengers on-board by the distance travelled (vehicle kilometers) by those types of buses. Passenger-kilometers for automobile travel are based on the number of registered vehicles and average annual distance travelled and average vehicle occupancy.

The Transport Canada TRAID database includes injury data for buses, but one province does not identify transit buses specifically, and the category "bus unspecified" may include some transit bus accidents. In addition, the TRAID database does not include data on light rail transit. The CUTA data, although not optimal, was considered to be a better source of transit injury data than TRAID. However, TRAID was used for transit fatality data as it was possible to screen the relatively small number of fatalities in the "bus unspecified" category and identify those on transit buses. Similarly, the rail fatalities recorded by the TSB were screened for those on transit type trains. Fatality data was also

obtained from the operators of rail transit and computer searches of news articles were used to verify this information and check for incomplete data.

Other potential sources of data on the safety and security record of transit are police departments and the insurance industry. These two sources of information are unfortunately of limited value.

The national reporting agency for the insurance industry is the Insurance Bureau of Canada. They record information by claim type, rather than incident. A particular accident could generate different types of claims such as personal injury, disability and death benefits. Their data is also limited to the provinces that do not have provincial insurance corporations and therefore excludes BC, Saskatchewan, Manitoba and Quebec. In addition, some transit systems may participate in insurance pools or self-insurance programs that do not report claims to the Bureau. The Bureau does maintain statistics, however, they are of limited use in contributing to an accurate national picture of the transit safety record.

Police forces across Canada also maintain some traffic accident and security data. Traffic accident data recorded by police are used in compiling the TRIAD database. Each police force also compiles statistics for its own use, but the detail and form of data can vary significantly between police forces. Police databases on security incidents do not include a searchable category indicating whether the incident was transit related, and the reports for incidents at bus stops do not always indicate any association with transit. In some metropolitan areas, such as Vancouver or Montreal, there can be multiple police forces and overlapping transit agencies that make the data difficult to use or collect.

Measurement Issues

The nature of accidents on the different modes differs and accident data recorded for the various modes includes different aspects of the passenger's trip. For example, for bus modes, pedestrians who are injured or killed by buses are in some cases passengers who have either not yet boarded or have exited the bus. This is not the case for automobile or aviation accidents. Transport Canada data on bus accidents classifies accidents involving a passenger getting on or off the bus, where the injury occurs outside the bus, as pedestrian accidents. However, the database also includes a field that indicates whether the pedestrian was getting in or out of a vehicle. In this analysis, it is assumed that in these accidents, the pedestrian was getting on or off the bus, and not some other vehicle; this is the most typical situation, but not always the case. Accidents involving passengers walking to and from the station or bus stop are classified as pedestrian accidents in the database, but it is not possible to identify those involving transit passengers. The safety measures given in this report do not consider the "access" segment of the transit trip.

Differences in reporting practices will also make direct comparisons between modes difficult. For example, injury data reported by transit agencies include injuries while at the station or bus stop, but air accidents do not include injuries to passengers at the airport terminal.

Another factor affecting safety that influences the comparison between modes is the environment of the trip. Travel speeds are lower in urban than non-urban environments, typically resulting in less severe accidents. However, the greater congestion in urban areas increases the likelihood of an accident. Comparisons of transit safety with the safety of other modes available in urban areas are therefore of particular relevance.

The distinction between travel by private and public modes should also be noted. For private modes of travel, such as the automobile or bicycle, the driver's safety is in their own hands. Some will drive in an extremely safe manner, and others will drive in a less safe manner, but the decision and the outcome are largely under their control. On public modes of travel, such as transit, the travelling public have little control of their safety once they have made the decision to travel by that mode, and put their safety in the hands of the transport operator. In these circumstances, a high degree of safety is warranted, and should be at least as good as that of the extremely safe driver of a private vehicle.

III. COMPARISON OF MODES

The safety levels of each mode are presented below and summarized in Section III-H. Detailed tables of fatalities, injuries, passenger-kilometers and the sources of data are given in Appendix A.

A. Transit

Transit provides an extremely safe means of transport, Exhibit III-1 provides a summary of the fatality and injury rates. Over the ten-year analysis period¹ only six passengers on-board transit vehicles died in collisions in transit accidents. During that time period, transit provided over 134 billion passenger kilometers of travel, thus giving an on-board passenger fatality rate of just 0.045 per billion passenger-kilometers. A greater risk to passengers occurs before, or as they get on, the transit vehicle, or when, or after, they exit the vehicle. The fatality rate of passengers getting on and off the vehicle or waiting at the station or platform was 0.112 per billion passenger kilometers over the 10 year period.

Exhibit III-1. Passenger Safety Rates for Transit in Canada[#]

On-board fatality rate	0.045	per billion passenger-km
Entry/exit/station fatality rate*	0.112	per billion passenger-km
Total pass. fatality rate*	0.157	per billion passenger-km
Injury rate**	300	per billion passenger-km

1988-1997 for bus transit and 1990-1999 for rail transit – see page footnote.

* Excludes walking to and from station/bus stop.

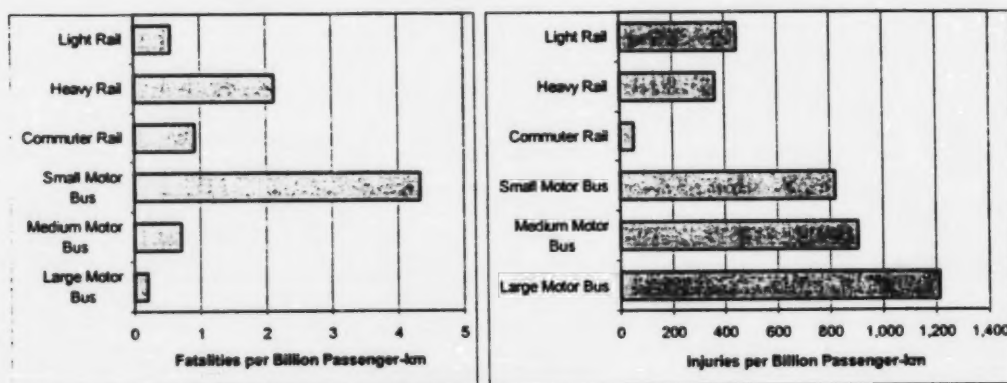
** Includes injuries sustained in collisions, while boarding or exiting the vehicle or while inside the vehicle or station or bus stop; based on data for 1993-1995.

The injury rate, estimated using data from CUTA, includes injuries sustained in collisions, while boarding or exiting the vehicle or while inside the vehicle or station or bus stop. The rate at 300 per billion passenger-kilometers was significantly higher than the fatality rate. These fatality and injury rates exclude accidents to passengers walking to and from station/bus stop.

The fatality and injury rates are based on estimated passenger-kilometers of travel as only some Canadian transit properties report this data. The rates are based on estimated average trip lengths of those properties reporting this data. Only 55% of transit agencies reported passenger-kilometers for the 1998 year, but the number reporting has increased greatly from the 35% that reported in 1994. One operator, Translink (the Vancouver transit system), is planning to report passenger kilometers as part of a new service monitoring system. U.S. properties are required by the Federal Transit Administration (FTA) to report passenger-miles of travel.

¹ 1988-1997 for bus transit (latest available data) and 1990-1999 for rail transit (due to the lack of a comprehensive database, the most reliable data is for the most recent 10 year period)

The FTA collects statistics on fatalities and injuries for various types of incidents and locations². The numbers of fatalities and injuries are broken down by patrons, employees and others (e.g., occupants of other vehicles). The types of incidents include collisions, run off road/derailment and personal casualties (non-collision). The categories of locations include: inside the vehicle, entering/exiting the vehicle, in the station/bus stop, and on the lift or escalators. The fatality and injury rates to passengers are shown for the different types of transit vehicles in Exhibit III-2. Overall modes the average rate is 1.27 fatalities per billion passenger-kilometers and 613 injuries per billion passenger-kilometers. The highest fatality rates are on the small buses, but the medium and large buses have lower fatality rates than rail transit. However, the injury rates are higher on bus than rail transit. The overall fatality and injury rates are significantly higher than in Canada³. The higher injury rates could, in part, be due to different levels of injury included and the quality of the Canadian data. As in Canada, a high proportion of the fatalities is due to collisions with people.



[Source: FTA, 1998]

* Injury includes any physical damage or harm to a person; there are no thresholds, all injuries are reported

Exhibit III-2 Fatality and Injury Rates of Passengers Involved in Transit Accidents in the US – 1998

The US data indicates that almost all fatalities (93%) occur in accidents involving a collision, while most of the reported injuries (65%) occur in non-collision accidents. Exhibit III-3 gives the distribution of the location fatalities and injuries occurring in non-collision accidents. A little under half the injuries occur on the vehicle, while about a quarter occur at the station or bus stop, and another quarter occur entering or exiting the vehicle. Also given in Exhibit III-3, are the distributions of fatalities and injuries by type of collision accident. Almost 80% of fatalities in collision accidents are due to collisions with people (included with pedestrian accidents in Canadian data), while 23% are due to collisions with vehicles.

² Safety Management Information Statistics (SAMIS) 1998 Annual Report, US Dept. of Transportation, Federal Transit Administration

³ Statistically significant at the 1% level

Exhibit III-3 Distribution of Fatalities and Injuries to Passengers by Location for Non-Collision Accidents and by Type for Collision Accidents

A. Non-Collision Accidents		
	Fatalities	Injuries
# of fatalities/injuries	21	25,044
Inside vehicles	47.6%	42.2%
In Station/ Bus stops	28.6%	25.0%
Entering/ Exiting vehicle	23.8%	28.1%
On lifts/ Escalators	0.0%	4.7%
B. Collision Accidents		
	Fatalities	Injuries
# of fatalities/injuries	53	13,423
With other vehicles	22.6%	91.9%
With objects	0.0%	5.6%
With people	77.4%	2.5%

[Source: FTA, 1998]

Similar systematic, comprehensive reporting of accident and passenger-kilometers of travel data by Canadian transit agencies would improve the accuracy of the estimated measures of safety and allow changes in the level of safety to be tracked over time. This is especially true for rail transit which is not included in any national accident database. In such a system, fatalities and injuries to transit passengers, transit staff and to other people should be recorded separately.

B. School Bus

As with transit, the level of safety afforded to children while travelling on the school bus is very good. The fatality and injury rates are given in Exhibit III-4. No distinction is made between urban and rural environments due to the lack of data. The number of pedestrians killed in accidents with school buses is much higher than the number killed on-board. Data obtained for several years indicates that roughly a third of these pedestrian accidents involve children getting on or off the bus. Seventy-two percent of the pedestrian fatalities involve people under 19 years of age, the same percentage of on-board passengers in that age group who are killed. Thus, other fatalities involving pedestrians also likely involve school children, for example crossing in front of bus after exiting. The total fatality rate is therefore given as a range, including and excluding these other pedestrian fatalities. It should be noted that the pedestrian fatality rate involving school buses from 1993 to 1997 was 75% less than prior to 1993.

Exhibit III-4. Passenger Safety Rates for School Buses in Canada (1988-1997)

On-board fatality rate	0.11 per billion passenger-km
Entry/exit fatality rate	0.24 per billion passenger-km

Other pedestrians fatality rate	0.43	per billion passenger-km
Total pass. fatality rate	0.35 – 0.78	per billion passenger-km
Injury rate*	60	per billion passenger-km

* Includes injuries to passengers on-board and entering and exiting the bus, and pedestrians

Although the total passenger fatality rate is higher than for transit, the injury rate is much lower than that of transit. The higher ratio of fatalities to injuries for school buses may be the result of various factors: children on school buses may be more likely to suffer serious injuries and less capable of surviving injuries incurred in an accident due to the younger age, and smaller size; a substantial portion of the passenger kilometers on school buses are operated on rural highways and secondary roads which involve higher speeds than urban transit; and vehicle design may also be a factor.

The comparison of the respective injury rates on transit and school buses would need to be examined more closely. On the one hand, the differences in definitions may affect the measurement of the relative rates, as may the recognized problems with the CUTA safety statistics data set (discontinued, in part, as a result of the poor quality of the data). On the other hand, the differences in the injury rates may reflect different operating conditions: school bus passengers are more stationary and their seats more protected; and transit involves much more passenger movement in the bus and has standees.

C. Automobile

Exhibit III-5 gives the fatality and injury rates for travel by motor vehicles in Canada. These rates are based on all motor vehicles, including commercial vehicles, trucks and buses. However, most of the travel and almost all the fatalities and injuries are to light duty vehicles and the rates provide a good measure of safety for these vehicles.

Exhibit III-5. Safety Rates for Travel by Motor Vehicles in Canada (1989-1998)

Urban Fatality rate	3.2	per billion passenger-km
Injury rate*	390	per billion passenger-km
Rural Fatality rate	10.8	per billion passenger-km
Injury rate*	270	per billion passenger-km

* Persons injured include all those who suffer any visible injury or complain of pain

Rates are given for both urban and rural driving to allow better comparisons with other modes. The fatality rates are much higher for rural driving, likely due to the higher speeds in rural environments. The higher injury rate in urban areas is likely due to the greater activity and congestion in urban areas resulting in more accidents, but the accidents are less severe due to the lower speeds.

D. Inter-City Bus

The fatality rate of inter-city buses over the last 10 years for which data are published (1988-1997) is strongly influenced by a single catastrophic accident in 1997 where 44 people were killed. The passenger fatality rate over the 10 years was 2.1 per billion passenger-kilometers, but would have been 0.7 had that accident not occurred. With the fatality rate influenced greatly by a single accident, a longer time period would give a better indication of the actual level of safety. The Royal Commission on National Passenger Transportation⁴ examined the period from 1985 to 1987 and found no fatalities to inter-city bus passengers. Including their data, the fatality rate over the period 1985-1997 was 1.6 per billion passenger-kilometers. The fatality rate is much higher than for transit, even excluding the one catastrophic accident. The fatality rate for pedestrians involved in accidents with inter-city buses, given in Exhibit III-6, is also higher than transit, but it is unlikely that many of these pedestrians were inter-city bus passengers. The injury rate for inter-city buses, which does not include injuries at the station or bus stop, is lower than the rate that has been estimated for transit.

Exhibit III-6. Passenger Safety Rates for Inter-City Buses in Canada (1988-1997)

On-board fatality rate	1.56 per billion passenger-km
Pedestrian fatality rate	0.66 per billion passenger-km
Injury rate*	120 per billion passenger-km

* Includes injuries to passengers on-board and entering and exiting the bus, and pedestrians

E. Inter-City Rail

The safety record of passengers on-board inter-city rail has been very good in Canada over the last decade. A total of six passengers died in three separate incidents on passenger trains in the 10 years from 1989 to 1998. The fatality rate over the period was 0.37 per billion-passenger-kilometers. Passenger trains carry a large number of people and although the probability of an accident is very small, there is potential for significant loss of life. In these circumstances, a longer time period will usually give a better indication of the safety level, although improvements in safety will be masked. Over the longer period 1981-1998 the on-board passenger fatality rate was 0.73 per billion passenger-kilometers.

The greatest risk posed by inter-city rail is to occupants of motor vehicles at railway crossings and to trespassers on the rail line. Fatality rates per billion passenger-kilometers of 7.2 for victims at crossings and 5.5 for trespassers were reported by the Royal

⁴ Directions: the final report of the Royal Commission on National Passenger Transportation, Canada, Volume 2 page 260, 1992

Commission on National Passenger Transportation⁵. Thus, inter-city rail is comparatively safe for the passengers on-board, but pose significant risk to non-rail users.

F. Air Carrier

The level of safety provided by air carriers varies greatly with the type of air carrier. To enable fatality rates to be derived, carriers were classified according to Transport Canada levels of carriers for which passenger-kilometers of travel are reported. Measuring the level of safety of travel by air is difficult due to the very low occurrence, but high consequences, of accidents. During the 10 year analysis period, the major two Canadian carriers had no fatal accidents and the fatality rate based on this period overestimates the level of safety provided. In contrast, for major charter airlines in that period, a single accident had 247 passenger fatalities, giving a fatality rate which would likely underestimate the level of safety. To further complicate the matter, the accident was for a charter flight between two foreign cities and none of the passengers were Canadians. Doubts remain as to whether this accident would have occurred in Canada.

Exhibit III-7 gives the fatality rates for various segments of aviation providing passenger transport. The fatality rate for the major Canadian carriers is zero in the last 10 years and 0.026 per billion passenger-kilometers over the period 1983 to 1998. The recent level of safety of the major Canadian carriers is consistent with that of major US scheduled carriers, where the fatality rate was 0.00014 per billion passenger-kilometers over the period 1987 to 1999.

Exhibit III-7. Passenger Safety Rates for Aviation in Canada[#]

Major Carriers	Level IA*	< 0.026	per billion passenger-km
Major Charter	Levels IB-II	0.06 – 1.8	per billion passenger-km
Regional Carriers	Levels IB-II**	0.5	per billion passenger-km
Commuter/Air taxi	Level III	3	per billion passenger-km

[#] Period 1983-98 for Level 1A, 1989-1998 for other levels

* Includes Air Canada and Canadian, and Pacific Western and Wardair, prior to 1990

** Includes Level I carriers Air BC and Time Air in 1991-1993

The fatality rate for major charter carriers is influenced by the single catastrophic accident and is in the range 0.06 to 1.8 fatalities per billion passenger-kilometers (with and without that accident). The fatality rate for the regional carriers operating large turbo prop (e.g., Dash 8, ATR 42) and small jet aircraft (e.g., F-28, Bae 146) is 0.51 per billion passenger-kilometers. This rate is also strongly influenced by a single accident, at Dryden in 1989 where 21 passengers were killed. The Level III commuter/air taxi class includes the larger operators of small aircraft in the 6 to 19 passenger seat range. The fatality rate for passengers travelling on these airlines is approximately 3 per billion passenger-

⁵ Directions: the final report of the Royal Commission on National Passenger Transportation, Canada, Volume 2 page 258, 1992.

kilometers. Accident rates are even higher for the smaller operators of these aircraft, but passenger-kilometer data is not of sufficient quality to estimate the fatality rate.

G. Other Modes

Passenger Ferry

Translink (formerly BC Transit) operates a passenger ferry "Seabus" service across Vancouver harbour. There have been no fatalities on this service in the last 10 years. This ferry service has provided only 17.5 million passenger-kilometers of travel, which is too low to give a meaningful measure of safety⁶.

The Transportation Safety Board provided information on fatalities in ferry accidents since 1990 indicating there have been 21 deaths in "accidents aboard ship" and 2 deaths in "shipping accidents". Most deaths were due to people falling overboard. Passenger-kilometers of travel are not published and can not be easily derived so no fatality rate could be calculated. However, the Royal Commission on National Transportation estimated the fatality rate in passenger operations to be about 1.0 death per billion pass-km based on data from 1981 to 1990. The number of fatalities during the last 10 years was similar to the 1981-90 period and the fatality rate of 1.0 should be a good measure for the latter period also.

Bicycle

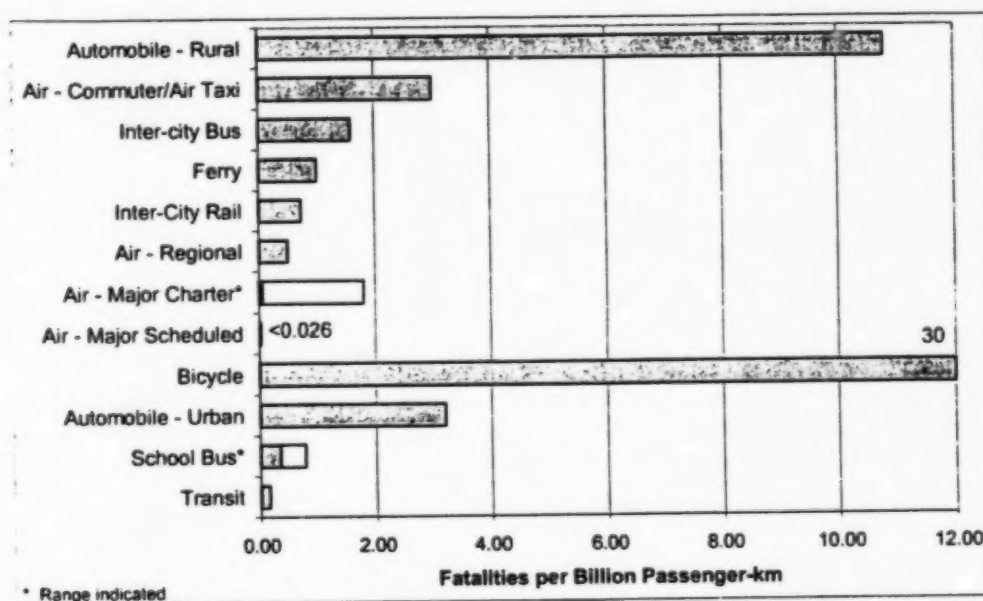
Bicycle travel is often promoted as a healthy alternative to travel by motor vehicle. Over the five years 1994 to 1998, on average, 71 bicyclists were killed each year on roads in Canada. The average number killed in the US each year over that period was 790, a similar rate per head of population to Canada. Based on various sources, the fatality rate for travel by bicycle in the US is estimated to be about 30 fatalities per billion kilometers of travel.

⁶ The fatality rate would jump to 57 per billion passenger-kilometers with just a single fatality

H. Summary

The different systems and procedures used to report transportation accident data make it difficult to accurately estimate the levels of safety of the various forms of passenger transportation. In addition, the types of risk (e.g., on or off the vehicle) and the operating environments differ significantly between modes. Despite these differences, it is possible to develop a fairly clear picture of the safety of transit relative to other modes of travel.

The passenger fatality rates for the different modes of travel examined are shown in Exhibit III-8. The modes used in urban areas are grouped together at the bottom of the figure. Transit has the lowest fatality rate in urban areas and the second lowest rate overall.



Notes: Rates based on most recent 10 year period data was available for Canada, except air, 16 years; inter-city bus, 13 years; and bicycle, 5 years US data.

Transit excludes fatalities walking to and from the station or bus stop.

School bus range is due to inclusion/exclusion of pedestrian accidents.

Air major charter range is due to inclusion/exclusion of one catastrophic accident

Exhibit III-8 Passenger Fatality Rates for Different Modes of Travel

Injury rates for transit are similar to those for urban and rural automobile travel, but higher than bus school and inter-city bus. Overall, transit provides the safest means of travel in urban areas, and only travel on major scheduled air carriers has lower fatalities for each passenger kilometer of travel.

Studies of comparative passenger transportation safety have found similar results. The fatality rates per billion passenger-kilometers in the UK⁷ and in the US (latter based on FWA and FTA data) are as follows:

	<u>UK</u>	<u>US</u>
Bus/coach (pass. & drivers)	0.33	0.87 (transit only)
Car occupants	3.9	
All road users	5.4	10.6
Rail passengers/staff	0.59	1.73 (transit only)

The UK report concluded that bus, coach and rail are by far the safest way to travel (air was not considered).

⁷ Public Transport Safety Briefing, The Federation of Passenger Transport, UK, 1998

IV. SAFETY AND SECURITY ISSUES

Security and personal safety are often cited by existing transit users and non-users as reasons for not using transit more frequently. Transit presents several different security concerns that are not present on other modes of transportation.

Transit security incidents can be divided into a number of categories:

- Violent criminal code offenses – i.e., use of force against an individual
- Property crime criminal code offences – i.e., theft, fraud, etc.
- Other criminal offences – i.e., prostitution, vandalism, etc.
- Transit/Municipal Bylaw and Provincial offences – loud music, fare violations, food/drink violations, liquor violations, mental health statutes, etc.

Transit patrons, in most cases, must wait for their transportation at open, unprotected street corners. Transit stations have fewer barriers to entry and less passive surveillance compared to other transportation terminals such as airports and inter-urban train stations. In addition, the public nature of transit (i.e., the low price of admission) makes people on-board the vehicles much more susceptible to security incidents than people on-board any other form of transportation. For example, payment of a relatively small fare (e.g., \$1.50) would give a pickpocket access to a crowded subway train or LRT. It is unlikely that a pickpocket would purchase a plane ticket, or inter-city rail ticket to gain access to potential targets. Certain categories of transportation such as school buses and private cars are, under normal circumstances, completely unavailable for criminal activity

It therefore appears that the most appropriate comparison of security is between transit and the general urban environment, rather than between transit and other modes of transportation. Statistics Canada maintains a complete and detailed database of criminal code activity by municipality. Only the largest transit systems in Canada collect and maintain statistics on security incidents. Ten transit properties across Canada were contacted to obtain statistics on security incidents, but only five properties responded. Of the five, only two (Translink and TTC) kept records of incidents. The small properties that responded, St. Albert and Brandon, advised that no statistics are maintained on criminal activity and the occurrences are extremely rare. BC Transit in Victoria maintains statistics on crimes against its staff and property (i.e., bus driver assaults and vandalism), but not on criminal activity impacting passengers.

One of the difficulties in compiling incident statistics for transit is that many incidents that might occur at bus stops involving passengers are not reported to the transit agency. Since the transit agency does not own or control street corner bus stops, the police would not have a reason to advise a transit agency of a problem.

Security incidents involving municipal or transit bylaws can not be compared as there may not be a parallel activity in the city as a whole. City to city comparisons are likewise

not possible as each transit property operates under a unique set of municipal or authority bylaws and regulations.

The security statistics that are available from transit properties must also be considered as rough indications of the level of crime. The transit properties recognize that there are many incidents, particularly at bus stops that may go unreported. In addition, there are likely many behavioural incidents that intimidate transit patrons that are not reported, or would be difficult to classify under a specific statute. There is no source of statistics that identifies criminal acts that occur during other transit related activities such as walking to and from a bus stop or station. Such data could only be collected by including specific transit related questions in crime incident data forms which, in the context of this data, is not feasible.

Exhibit IV-1 compares the crime rates in 12 major Canadian cities. The exhibit also shows the crime rate (criminal code offenses) as reported by the two properties from which statistics were available. With only two properties reporting, the results cannot be considered complete. The results do show, however, that transit passengers on the system are exposed to crime rates that are about 2,000 to 17,000 times lower than the crime rates in the surrounding city. Even allowing for the small proportion of each person's day spent on transit, these reported incidents indicate the frequency of criminal activity on transit is low. For example, if a person spends one hour per day, five days a week using transit (including waiting at stops), that represents approximately 2.7% of the year. Assuming passengers take two trips per day, if criminal activity on transit was the same as other activities, criminal activity on transit should be 1.3% [0.5 x 2.7%] of, or 1/74th the city crime rates. Clearly, it is far below this level.

Exhibit IV-1. Urban Crime Rates and Criminal Activity on Transit 1997

City	Urban Crime Rate			Transit System Crime Rate			
	Rates per 100,000 population			Rates per 100,000 revenue passengers			
	Violent Crime	Property Crime	Total Criminal Code	Violent Crime	Property Crime	Criminal Code	Municipal, Transit, Provincial Violations
St John's	1,002	3,999	6,966				
Saint John	1,344	4,670	8,406				
Halifax	1,441	7,455	11,847				
Montreal (MUC)	1,039	6,202	9,010				
Ottawa	1,040	5,877	9,331				
Toronto	1,097	4,718	8,027			0.5	1.2
Winnipeg	1,519	6,189	10,629				
Saskatoon	1,487	7,398	12,880				
Edmonton	1,078	6,190	10,073				
Calgary	859	5,457	8,025				
Greater Vancouver*	1,269	9,272	13,141	0.8	0.9	4.4	0.9
Victoria Capital Region	1,674	7,057	13,368				

*Crime statistics for Skytrain only

[Source: Statistics Canada and individual transit properties]

The numbers in Exhibit IV-1 clearly show that passengers using public transit are comparatively safe from criminal activity. The perception that transit is not safe may also be a factor in keeping the crime numbers so low. This perception may be keeping away potential users that would be the most vulnerable to criminal activity, thus creating lower than expected crime rates. Transit properties with dedicated security or police departments are most able to compile security statistics. Properties without dedicated security staff tend not to become involved in, or informed of incidents unless their own staff are impacted (e.g., driver assaults).

The Federal Transit Administration commenced collection of security data as part of their Safety Management Information System (SAMIS) in 1996. The system uses a standard reporting procedure with three general categories, violent crime, property crime and arrest, similar to those used by the Canadian transit properties, and 18 sub-categories. Definitions used by the FTA for the categories of security incidents are given in Appendix B. The numbers of incidents and the incident rates per 100,000 passengers for each category in 1997 are given in Exhibit IV-2. The incident rates for each of the three categories are higher than for the two Canadian operators providing data, but given the limited Canadian data, little significance could be inferred from this. The US rates are still much less than the urban crime rates for Canadian cities, even allowing for the small time spent on transit.

Exhibit IV-2. Security Incidents on US Transit and Incident Rates per 100,000 Passengers (1997)

	Number	Rate
Violent crime		
Homicide	19	0.002
Rape	29	0.004
Robbery	4,729	0.621
Aggravated Assault	3,045	0.400
Total	7,822	1.027
Property crime		
Theft	14,199	1.86
Vehicle Theft	2,146	0.28
Burglary	1,698	0.22
Arson	72	0.01
Total	18,115	2.38
Arrests		
Other assaults	2,594	0.34
Vandalism	9,221	1.21
Sex offenses	997	0.13
Drug Abuse	4,302	0.56
Driving under influence	199	0.03
Drunkenness	8,010	1.05
Disorderly conduct	24,442	3.21
Trespassing	6,025	0.79
Fare evasion	53,252	6.99
Loitering	1,419	0.19
Total	110,461	14.51

[Source: 1997 National Transit Summaries and Trends, FTA]

The variation in regulations and statutes at the provincial, municipal and transit property level means that the only statistics that can be compared nationally are criminal code violations.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Transit is the safest form of travel in urban areas in Canada and, considering all types of travel, is second only to travel by air on major scheduled air carriers. The number of fatalities per passenger-kilometer of travel is less than one twentieth that of travel by automobile.

Provincial motor vehicle accident data compiled into a national database by Transport Canada is not ideal for tracking the safety of transit and making comparisons with other modes. One province does not distinguish between bus type (transit, inter-city or other). The data does not include injuries at bus stops and stations unless a vehicle is involved, and for pedestrian accidents, it is not clear whether the pedestrian was a transit passenger. Given the good safety record for passengers on board transit, it is likely that the least safe portion of a transit journey is the walking from home (or work) to the bus stop. However, no data sources available can be used to reliably estimate the safety on this portion of the trip, and collection of that data would be extremely difficult. Rail accident data is collected by the Transportation Safety Board and do not include injuries to passengers at stations.

The limited data available shows that transit passengers in stations or on-board transit vehicles are substantially more secure than the overall urban population. There are no national guidelines to assist transit properties in collecting security statistics. The perceptions that may exist about the lack of security on transit may be more related to the potential for incidents beyond the transit service itself, such as walking between a bus stop and place of residence.

Developing a complete and accurate picture of transit safety and security will be difficult. Standardized reporting of accidents and security incidents by the transit agencies would provide measures of safety and security while on transit property. Currently, rail transit accidents are not included in any national database. The safety and security of passenger walking to and from the station or bus stop, or while waiting at bus stops could only be measured by including specific transit related questions in incident/accident data forms. In the wider context that this data is collected, inclusion of specific transit related questions could not be justified.

B. Recommendations

Based on our analyses and findings, we recommend the following:

Relative Safety/Security of transit

- Publicize and promote the excellent safety and security record of transit to draw public support for transit and increase ridership.

Data collection requirements

- Passenger-kilometers of travel data should be collected to enable accurate injury and fatality rates to be determined.
- There should be routine reporting of fatalities and injuries using standardized reporting procedures, similar to those used by the US Federal Transit Administration. Fatalities and injuries should be recorded separately for transit passengers, transit staff and for other people involved in accidents with transit vehicles.
- There should be routine reporting of security incidents involving passengers using standardized reporting procedures based on criminal code activity, similar to those used by the US Federal Transit Administration.

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Appendix A

Calculation of Fatality and Injury Rates

1. Automobile

Year	# of Fatalities		# of Injuries		Driver+Pass-km		Fatalities per billion driver & pass-km		Injuries per billion driver & pass-km	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
					(Million)	(Million)				
1988	1,178	2,312	130,251	59,014	297,998	181,099	4.0	12.8	437	326
1989	1,191	2,349	135,714	56,308	305,668	185,760	3.9	12.6	444	303
1990	1,130	2,211	126,085	52,769	310,326	188,590	3.6	11.7	406	280
1991	1,054	2,072	119,888	49,910	294,884	179,206	3.6	11.6	407	279
1992	972	2,014	119,415	49,251	296,165	179,985	3.3	11.2	403	274
1993	920	2,112	118,919	48,824	298,178	181,208	3.1	11.7	399	269
1994	918	1,868	118,554	48,081	302,964	184,116	3.0	10.1	391	261
1995	894	1,896	114,541	49,558	304,594	185,107	2.9	10.2	376	268
1996	862	1,786	109,618	46,650	309,904	188,334	2.8	9.5	354	248
1997	817	1,767	105,527	44,514	312,960	190,191	2.6	9.3	337	234
1998	862	1,658	106,427	41,900	321,761	195,539	2.7	8.5	331	214
Total	10,797	22,044	1,304,940	546,778	3,355,402	2,039,135	3.2	10.8	389	268

Notes:

Fatalities excludes pedestrians and bicyclists (assumes 95% bicycle fatalities in urban areas)

Number of injuries includes cyclists (numbers of injuries not published for cyclists)

Driver + passenger-km is estimated from no. of registered vehicles (private, commercial & motorcycle) and avg. annual km per vehicle

Average km per year private vehicles 17,000 km
commercial vehicles 35,000 km
motorcycles 5,000 km (Estimate)

Average people per vehicle = 1.4 from National Driving Survey 1981.

% of driving on urban roads = 62.2% from National Driving Survey 1981.

Sources:

Fatalities & injuries - Canadian Motor Vehicle Collision Statistics, Transport Canada, report no. TP 3322 for years 1988-1998

Vehicle registrations- Canadian Motor Vehicle Collision Statistics, Transport Canada, report no. TP 3322 for years 1988-1998

Private vehicle-km Transport in Canada, Annual Report 1998, Transport Canada, report # TP 13198E

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2. Transit

Fatalities

Year	# of Fatalities				Pass-km (Million)	Pass. Trips (Million)	Vehicles	Veh-km (Million)
	Transit Rail Pass.		Transit Bus Pass.					
	Onboard	at Station	Onboard	Entry/Exit				
1988			1	1	14,239	1,514.82	13,344	749.04
1989			0	2	14,292	1,520.42	12,720	780.64
1990	0	0	0	0	14,367	1,528.40	13,156	769.33
1991	0	2	0	1	13,631	1,450.06	13,542	780.83
1992	0	0	2	0	13,462	1,432.10	12,956	754.40
1993	0	0	0	0	13,127	1,396.45	13,527	756.63
1994	0	1	0	2	12,791	1,360.71	13,411	776.47
1995	3	1	0	0	12,794	1,361.06	13,140	742.26
1996	0	2	0	0	12,717	1,352.87	13,049	716.37
1997	0	2	0	0	12,657	1,346.50	13,146	768.01
1998	0	1						
1999	0	0						
Total	3	9	3	6	134,076	14,263.39	131,991	7,594

Ten Year Totals:

	Fatalities	Fatalities per B.pass-km
Onboard	6	0.045
Entry/Exit/Station	15	0.112
Total	21	0.157

Sources:

Fatalities	Bus	Special request, Traffic Safety Standards and Research Branch, Road Safety and Motor Vehicle Registration Directorate, Transport Canada For a small number of "Buses (unspecified)" the vehicle make, road category & posted speed limit was used to determine if bus was a transit, inter-city, school bus or other type of bus.
	Rail	TSB Special request, data provided by Maury Hill, computer search of news articles, and Edmonton, Vancouver, Toronto Transit Commission, Calgary and Montreal transit operators (No reply had been received from Toronto GO Transit, fatalities based on news article search)
Passenger trips		Statistics Canada 53-215-XPB "Passenger Bus and Urban Transit Statistics"
Passenger-km		Estimated from veh-km assuming: Avg. pass. trip length = 9.4 km Avg. trip length of 9.4 km calculated from CUTA Canadian Transit Fact Book 1997 Operating Data
Vehicles & veh-km		Statistics Canada 53-215-XPB "Passenger Bus and Urban Transit Statistics"

Note: Bus transit fatality and passenger-km data only available up to 1997. Most recent transit rail fatality data used (1990-1999) as it is the most reliable. Approximation used that rail transit pass-km in 1998-99 are similar to 1988-89. Given fatality rates are over a 10 year time frame and pass-km by rail is less than by bus transit, the approximation will have little effect on the estimated fatality rate.

ACCIDENTS/PASSENGER INJURIES

Includes Bus, Rail and Other forms of transit

CONVENTIONAL TRANSIT

Transit	No. of Passengers Trips			Avg km per trip	No. of Passenger Injuries			Passenger Injuries per Million Passenger-km		
	1993	1994	1995		1993	1994	1995	1993	1994	1995
Over 12 Million Kilometres										
Toronto	393,485,000	388,252,000	388,152,000	9.0 *	1,116	1,149	1,202	0.32	0.33	0.35
Ottawa	76,052,000	73,277,966	71,669,185	8.7	290	351	376	0.44	0.55	0.60
Edmonton	39,199,508	38,050,000	37,157,545	7.0	288	375	130	1.05	1.41	0.50
Calgary	53,269,100	53,866,100	56,300,900	12.0	193	208	237	0.30	0.32	0.35
Winnipeg	44,366,451	41,622,826	39,908,000	9.0 *	14	18	10	0.04	0.05	0.03
Mississauga	20,159,436	20,035,803	20,726,843	9.0 *	65	72	35	0.36	0.40	0.19
Montreal RS	N/A	26,074,817	25,605,434	8.2	N/A	40	55	N/A	0.19	0.26
GO Transit	34,794,000	34,491,000	33,290,000	9.0 *	16	20	24	0.05	0.06	0.08
TOTAL	661,325,495	675,670,312	672,809,707	9.0	1,982	2,233	2,069	0.33	0.37	0.34
Between 2-12 Million Kilometres										
Victoria	15,923,931	16,872,612	17,016,515	17.3 *	36	35	47	0.13	0.12	0.16
London	13,357,200	12,444,100	12,050,200	17.3 *	46	51	33	0.20	0.24	0.16
Halifax	13,512,117	13,031,304	13,059,860	17.3 *	6	24	17	0.03	0.11	0.08
Outaouais	10,162,891	10,470,912	10,547,838	25.1	23	11	10	0.09	0.04	0.04
Kitchener	8,414,674	8,247,889	8,253,043	17.3 *	6	9	5	0.04	0.06	0.04
Sherbrooke	6,758,359	6,902,392	6,719,052	23.6	44	41	33	0.28	0.25	0.21
Brampton	4,792,269	4,617,048	4,919,497	17.3 *	5	1	4	0.06	0.01	0.05
Thunder Bay	3,533,074	3,353,395	3,419,807	7.0	22	24	39	0.89	1.02	1.63
Sudbury	4,051,920	3,854,397	3,776,226	17.3 *	19	17	14	0.27	0.26	0.21
St Catharines	3,047,828	3,103,261	3,077,965	8.6	0	5	4	0.00	0.19	0.15
St John's	3,291,699	2,883,769	3,030,735	20.0	6	2	4	0.09	0.03	0.07
Oakville	2,036,544	1,936,650	1,884,573	17.3 *	0	2	1	0.00	0.06	0.03
Markham	2,669,699	2,704,604	2,811,528	17.3 *	0	0	3	0.00	0.00	0.06
Vaughan	N/A	N/A	1,983,784	19.2	N/A	N/A	5	N/A	N/A	0.13
Saint John	2,403,843	2,351,983	2,298,813	17.3 *	12	5	6	0.29	0.12	0.15
TOTAL	93,956,248	92,774,316	94,849,438	17.3	225	227	225	0.14	0.14	0.14
Under 2 Million Kilometres										
Guelph	3,131,120	3,261,268	3,394,357	12.0	4	6	6	0.11	0.15	0.15
St Albert	903,946	894,195	875,876	11.8 *	2	2	1	0.19	0.19	0.10
Brantford	1,214,258	1,246,361	1,289,508	11.0	1	0	1	0.07	0.00	0.07
Strathcona	848,769	924,600	916,000	20.2	0	2	0	0.00	0.11	0.00
Richmond Hill	716,527	784,713	755,170	11.8 *	7	3	3	0.83	0.32	0.34
Red Deer	1,837,000	1,858,000	1,892,956	11.8 *	0	0	0	0.00	0.00	0.00
Niagara Falls	1,251,150	1,222,123	1,217,987	11.8 *	0	3	1	0.00	0.21	0.07
Comwall	1,645,053	1,650,964	1,586,971	6.0	4	0	1	0.41	0.00	0.11
Newmarket	817,296	797,940	831,615	15.0	0	0	0	0.00	0.00	0.00
Medicine Hat	773,300	757,288	779,498	11.8 *	1	1	1	0.11	0.11	0.11
Ajax	1,350,000	1,300,000	1,329,064	13.5	3	1	0	0.16	0.06	0.00
Belleville	681,266	665,113	658,581	11.8 *	0	0	2	0.00	0.00	0.26
Stratford	597,319	656,605	671,062	4.8	2	4	4	0.70	1.27	1.24
Whitehorse	422,901	417,828	432,058	11.8 *	0	0	0	0.00	0.00	0.00
Woodstock	384,603	357,008	335,713	11.8 *	1	3	0	0.22	0.71	0.00
TOTAL	16,574,508	16,794,006	16,966,416	11.8	25	25	20	0.13	0.13	0.10
OVERALL	771,856,251	785,238,634	784,625,561	10.0	2,232	2,485	2,314	0.29	0.32	0.29
								avg 3 yrs all agencies		
								0.30		

* Estimated trip length, estimate based on average trip length for transit properties in that transit category

Source:

Injuries & passenger trip: CUTA Transit Safety Statistics 1995 Data

Passenger-kilometers: Based on # of trips and average trip length calculated from CUTA Canadian Transit Fact Book 1997 Operating Data

Note - injuries includes injuries in collision accidents (collisions with other vehicles, people and objects), and non-collision incidents

(boarding and alighting vehicle, inside vehicle, and in station/bus stop, involving stairs, elevators, escalators, passageways, platform)

3. School Bus

Fatality Rate

Year	# of Fatalities			Fatalities per B.pass-km		Pass-km (Million)	Pass. Trips (Million)	Vehicles	Veh-km (Million)
	Driver	Passenger	Pedestrian	Passenger	Pedestrian				
1988	1	0	8	0.00	1.22	6,581	720	22,554	438.7
1989	1	2	6	0.29	0.88	6,800	744	21,436	453.3
1990	0	1	7	0.15	1.07	6,554	717	20,706	437.0
1991	1	2	8	0.33	1.32	6,058	663	21,560	403.9
1992	0	0	8	0.00	1.11	7,237	792	25,071	482.5
1993	0	0	2	0.00	0.29	6,840	748	24,416	456.0
1994	0	3	1	0.38	0.13	7,818	855	54,504	521.2
1995	0	0	2	0.00	0.21	9,691	1,060	26,513	646.0
1996	0	0	7	0.00	0.78	9,005	985	28,133	600.3
1997	0	0	2	0.00	0.22	9,005	985	28,133	600
1988-97	3	8	51	0.11	0.67	75,587	8,267	273,026	5,039

* Other tables prepared by TC indicate that there were only 45 fatalities to pedestrians in school buses accidents
The fatality rate would then be 0.60 based on this lower number of fatalities

Injury Rate

Year	# of Injuries			Injuries per M.pass-km		Pass-km (Million)	Pass. Trips (Million)	Vehicles	Veh-km (Million)
	Driver	Passenger	Pedestrian	Passenger	Pedestrian				
1988	106	317	76	0.05	0.01	6,581	720	22,554	438.7
1989	123	338	83	0.05	0.01	6,800	744	21,436	453.3
1990	126	460	80	0.07	0.01	6,554	717	20,706	437.0
1991	91	516	73	0.09	0.01	6,058	663	21,560	403.9
1992	109	329	66	0.05	0.01	7,237	792	25,071	482.5
1993	88	309	62	0.05	0.01	6,840	748	24,416	456.0
1994	102	444	56	0.06	0.01	7,818	855	54,504	521.2
1995	108	384	69	0.04	0.01	9,691	1,060	26,513	646.0
1996	95	310	41	0.03	0.00	9,005	985	28,133	600.3
1997	87	299	44	0.03	0.00	9,005	985	28,133	600
1988-97	1035	3706	650	0.05	0.01	75,587	8,267	273,026	5,039

Sources:

Fatalities & injuries "School Bus Collisions 1998-1997" Transport Canada Safety and Security, Road Safety, Leaflet # CL9906(E), Dec. 1999

Passenger trips Estimated from passenger kilometers and average trip distance for 1988 (9.1 km)

Passenger-km Estimated from veh-km assuming: Avg. Pass on-board = 15

Average passengers estimated based on capacity of 40, assuming third of trip has no one onboard, and that passengers load evenly for 57% of travel and bus is fully loaded for 10% of travel.

Vehicles & veh-km Statistics Canada 53-215-XPB "Passenger Bus and Urban Transit Statistics"

1997 values assumed equal to values for 1996 (1997 Cat. Not in library)

4. Inter-City Bus

Fatalities

Year	# of Fatalities			Fatalities per B. pass-km		Pass-km (Million)	Pass. Trips (Million)	Vehicles	Veh-km (Million)
	Driver	Passengers	Pedestrian	Passengers	Pedestrian				
1985-1987		0		0.00		9,900			
1988	0	1	1	0.32	0.32	3,168	18,262	1,309	157,052
1989	0	2	0	0.64	0.00	3,147	17,233	1,273	156,039
1990	0	6	1	1.77	0.29	3,392	16,991	1,356	168,159
1991	1	0	3	0.00	0.91	3,300	15,916	1,430	163,601
1992	0	0	3	0.00	1.00	2,996	14,872	1,388	148,526
1993	0	2	0	0.71	0.00	2,798	10,863	1,252	138,695
1994	1	3	3	0.90	0.90	3,345	11,438	1,388	165,843
1995	1	5	2	1.61	0.64	3,102	11,186	1,191	153,776
1996	0	0	2	0.00	0.76	2,629	10,270	1,052	130,359
1997	2	44	5	16.73	1.90	2,629	10.3	1,052	130
1988-97	5	63	20	2.07	0.66	30,507			
1988-96	3	19	15	0.68	0.54	27,877	Excluding year with large # of fatalities		
1985-1997		63		1.56		40,407			

Injuries

Year	# of Injuries			Injuries per M. pass-km		Pass-km (Million)	Pass. Trips (Million)	Vehicles	Veh-km (Million)
	Driver	Passengers	Pedestrian	Passengers	Pedestrian				
1988	75	315	48	0.099	0.015	3,168	18,262	1,309	157,052
1989	91	428	38	0.136	0.012	3,147	17,233	1,273	156,039
1990	93	395	52	0.116	0.015	3,392	16,991	1,356	168,159
1991	72	328	38	0.099	0.012	3,300	15,916	1,430	163,601
1992	73	229	48	0.077	0.016	2,996	14,872	1,388	148,526
1993	68	285	48	0.102	0.017	2,798	10,863	1,252	138,695
1994	86	361	37	0.108	0.011	3,345	11,438	1,388	165,843
1995	54	286	36	0.092	0.011	3,102	11,186	1,191	153,776
1996	44	314	48	0.119	0.018	2,629	10,270	1,052	130,359
1997	63	290	35	0.110	0.013	2,629	10.3	1,052	130
1988-97	716	3,232	428	0.106	0.014	30,507	137	12,691	1,512

Pass + Ped. = 0.120

Sources:

Fatalities and injuries	Special request, Traffic Safety Standards and Research Branch, Road Safety and Motor Vehicle Registration Directorate, Transport Canada
Fatalities	For a small number of "Buses (unspecified)" the vehicle make, road category & posted speed limit was used to determine if bus was a transit, inter-city, school or other type of bus.
Injuries	Sum of injuries for category "Inter-city buses" and a proportion of the injuries for the category "Buses (unspecified)", the proportion based on the proportion of fatalities for intercity buses that were on buses classified as "Buses (unspecified)"
Passenger trips	Statistics Canada 53-215-XPB "Passenger Bus and Urban Transit Statistics"
Passenger-km	Estimated from veh-km assuming: Avg. Pass on-board = 20.2 for other years Avg. passengers of 20.2 based on passenger-km given by: Royal Commission on Nat. Pax Transp 1992 1997 values assumed equal to values for 1996 (1997 Cat. Not in library)
Vehicles & veh-km	Statistics Canada Cat. 53-215-XPB "Passenger Bus and Urban Transit Statistics"

5. Inter-City Rail

Year	Pass. Fatalities	Pass-km (Million)	Fatalities per Billion pass-km	Pass. Trips (000)	Average Trip km	Class I		Class II-III	
						Pass-km (000)	Pass. Trips (000)	Pass-km (000)	Pass. Trips (000)
					est.				
1989	0	2,798	0.00						
1990	0	1,473	0.00	4,397	335	1,285,678	3,564	718,682	25,555
1991	0	1,426	0.00	4,256	335	1,319,955	3,633	105,664	623
1992	4	1,439	2.78	4,241	339	1,342,877	3,623	96,245	618
1993	0	1,413	0.00	4,112	344	1,319,030	3,570	93,723	542
1994	0	1,440	0.00	4,184	344	1,342,421	3,586	97,511	598
1995	0	1,473	0.00	4,082	361	1,382,568	3,597	90,052	485
1996	0	1,519	0.00	4,060	374	1,436,198	3,666	82,771	394
1997	2	1,515	1.32	4,104	369	1,423,479	3,765	91,113	339
1998	0	1,515	0.00						
1989-98	6	16,009	0.37						
1981-1988	20	19,837	1.01						
1981-1998	26	35,846	0.73						

Sources:

Fatalities TSB Special request, data provided by Maury Hill
 Passenger trips Statistics Canada Cat. 52-216, "Rail in Canada"
 Passenger-km Statistics Canada Cat. 52-216, "Rail in Canada"
 Vehicles & veh-km Statistics Canada Cat. 52-216, "Rail in Canada"

6. Ferry

Seabus Ferry Passenger Fatality Rates

Year	Fatalities	Passengers	Pass-km (000)	Fatalities per billion km
1988	0	4,300,000	1,340	0.0
1989	0	4,300,000	1,340	0.0
1990	0	4,309,220	1,347	0.0
1991	0	4,299,665	1,344	0.0
1992	0	4,241,779	1,326	0.0
1993	0	4,154,600	1,298	0.0
1994	0	4,440,252	1,388	0.0
1995	0	4,845,163	1,514	0.0
1996	0	5,591,427	1,747	0.0
1997	0	5,417,162	1,693	0.0
1998	0	5,090,913	1,591	0.0
1999	0	5,100,786	1,594	0.0
1988-99	0	56,090,967	17,521	0.0
If fatalities	1	then fatality rate = 57		

Notes: Distance of ferry trip (km) 3.2

Source: Fatalities Transportation Safety Board, special request
 Passenger km Translink, BC, special request

7. Aviation

Year	Fatalities	Pass.-km million	Rate per billion pass.-km
Air Canada & Canadian (Level 1A)			
1983-87	20	191,520	0.10
1988	0	54,122	0.00
1989	0	53,048	0.00
1990	0	50,125	0.00
1991	0	42,176	0.00
1992	0	44,619	0.00
1993	0	43,752	0.00
1994	0	46,751	0.00
1995	0	52,252	0.00
1996	0	56,854	0.00
1997	0	61,723	0.00
1998	0	64,000	0.00
Total 1983-98	20	760,941	0.026
Total 1989-98	0	515,300	0.00
Major Charters (Level 1B-II)			
1989		6,862	
1990		12,077	
1991		11,638	
1992		13,169	
1993		11,935	
1994		11,440	
1995		14,371	
1996		15,344	
1997		21,226	
1998		22,287 est.	
Total	255	140,348	1.8
Total excl 1 acc.	8		0.06
Regional Carriers (Level 1B-II)			
1989		3,253	
1990		3,806	
1991		3,618	
1992		3,750	
1993		3,305	
1994		3,289	
1995		4,248	
1996		6,906	
1997		7,370	
1998		7,739 est.	
Total	24	47,285	0.51
Commuter Carriers (Levels 3)			
1989		4,961	
1990		3,223	
1991		312	
1992		570	
1993		2,031	
1994		4,160	
1995		2,629	
1996		968	
1997		862	
1998		905 est.	
Total	61	20,621	2.96

Pass.-km Statistics Canada Catalogue 51-206 Annual Canadian Civil Aviation
 Fatalities Transportation Safety Board, Annual reports, and special request

8. Bicycle

1. US Data

Activity	Fatalities per million exp. Hrs	Est. Fatalities per billion pass-km	Assumed average speed
On-road Motorcycling	8.8	146.7	60 km/h
General aviation	15.58	77.9	200 km/h
Bicycling	0.26	32.5	8 km/h
Passenger cars	0.47	7.8	60 km/h
School bus	0.022	0.9	25 km/h
Airline passenger (sched. dom.)	0.15	0.3	600 km/h

Source: Failure Analysis Associates, 1995

(web site: www.helmuts.org/webdocs/stats.htm)

Type of Bicyclist	# cyclists (M)	Days/yr*	km/day*	Dist./year	Total M.km
commuters	4.9	200	10	2,000	9,800
racers	0.25	200	30	6,000	1,500
mountain	25	25	20	500	12,500
tourers	1.7	25	100	2,500	4,250
recreational	3.8	25	10	250	950
Total	35.65				29,000
Deaths in 1995	827				
Est. fatalities per billion pass-km	29				

* Assumed

Source: Deaths in 1995 Fatality Factors: Bicycles, Insurance Institute for Bicycle Safety
Numbers of cyclists Reported by the National Bicycle Dealers Association
(web site: www.helmuts.org/webdocs/stats.htm)

Bicycle - deaths per million trips	0.5
Average distance of trip (km)*	10
Est. fatalities per billion pass-km	50

* Assumed

Source: A Monograph by the Johns Hopkins Injury Prevention Centre (sponsored by the Snell Memorial Foundation)

(web site: www.helmuts.org/webdocs/stats.htm)

2. Canadian Data

Bicyclists Killed on Roads in Canada

Year	# Killed
1994	86
1995	64
1996	60
1997	67
1998	76
Average	70.6

Canadian Motor Vehicle Collision Statistics, Transport Canada, report no. TP 3322 for years 1988-1998

Appendix B

FTA Security Definitions

Security Definitions

Source: Federal Transit Administration, 1998. Safety Management Information Statistics (SAMIS) 1998 Annual Report, US Dept. of Transportation.

Part I Offenses (Reports):

Homicide

The killing of one or more human beings by another. This includes murder, non-negligent manslaughter and manslaughter by negligence.

Forcible Rape

The carnal knowledge of a female forcibly and against her will. This includes rape and attempt to rape.

Robbery

The taking or attempting to take anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear. The use or threat of force includes firearms, knives or cutting instruments, other dangerous weapons (clubs, acid, explosives), and strong-arm techniques (hands, fists, feet).

Aggravated Assault

An unlawful attack by one person upon another for the purpose of inflicting severe or aggravated bodily injury. This type of assault usually is accompanied by the use of a weapon or by means likely to produce death or great bodily harm.

Larceny/Theft

The unlawful taking, carrying, leading, or riding away of property from the possession or constructive possession of another. This includes pocket-picking, purse-snatching, shoplifting, thefts from motor vehicles, thefts of motor vehicle parts and accessories, theft of bicycles, theft from buildings, theft from coin-operated devices or machines, and all other theft not specifically classified.

Motor Vehicle Theft

The theft or attempted theft of a motor vehicle. A motor vehicle is a self-propelled vehicle that runs on the surface of land and not rails. Examples of motor vehicles are automobiles, trucks, buses, motorcycles, motor scooters, etc.

Burglary

The unlawful entry of a structure to commit a felony or a theft. This includes offenses known locally as burglary (any degree), unlawful entry with intent to commit a larceny or felony, breaking and entering with intent to commit a larceny, housebreaking, safecracking, and all attempts at these offenses.

Arson

To unlawfully and intentionally damage, or attempt to damage, any real or personal property by fire or incendiary device.

Part II Offenses (Arrests):

Other Assault

An unlawful attack or attempt by one person upon another where no weapon was used or which did not result in serious or aggravated injury to the victim. This includes simple assault, minor assault, assault and battery, injury by culpable negligence, intimidation, coercion, hazing, and all attempts to commit these offenses.

Vandalism

The willful or malicious destruction, injury, disfigurement, or defacement of any public or private property, real or personal, without consent of the owner or person having custody or control by cutting, tearing, breaking, marking, painting, drawing, covering with filth, or any other such means as may be specified by local law.

Sex Offenses

Any sexual acts except forcible rape, prostitution, and commercialized vice. This includes offenses against chastity, common decency, morals, and the like, such as: adultery and fornication; buggery; incest; indecent exposure; indecent liberties; seduction; sodomy or crime against nature; statutory rape (no force); and all attempts to commit any of the above.

Drug Abuse Violations

Arrests requested based on the narcotics used. This includes all arrests for violations of state and local laws, specifically those relating to the unlawful possession, sale, use, growing, manufacturing, and making of narcotic drugs.

Driving Under the Influence (DUI)

The driving or operating of any vehicle or common carrier while drunk or under the influence of liquor or narcotics.

Drunkenness

Arrests for all offenses of drunkenness, defined as the consumption of alcoholic beverages to the extent that one's mental faculties and physical coordination are substantially impaired. This includes drunkenness, drunk and disorderly, common or habitual drunkard, and intoxication.

Disorderly Conduct

All charges of committing a breach of the peace. This includes affray; unlawful assembly; disturbing the peace; disturbing meetings, disorderly conduct in state institutions, at court, at fairs, on trains or public conveyances, etc.; blasphemy, profanity, and obscene language; desecrating the flag; refusing to assist an officer; and all attempts to commit any of the above.

Trespass

To unlawfully enter land, a dwelling, or other real property.

Fare Evasion

The unlawful use of transit facilities by riding without paying the applicable fare.

Curfew and Loitering

All arrests for violations of local curfew or loitering ordinances where such laws exist.